WHAT IS CLAIMED IS:

1. An optical signal processing device, comprising:

an input optical waveguide;

an optical splitter configured to split optical signals entered at the input optical waveguide into plural sets;

an optical delay waveguide array formed by a plurality of optical delay waveguides with mutually different delay amounts which are configured to delay the optical signals split by the optical splitter;

an optical combiner configured to combine the optical signals delayed by the optical delay waveguide array;

an output optical waveguide connected to an output port of the optical combiner; and

an optical gate configured to gate the optical signals outputted from the optical combiner or entered into the optical delay waveguide array;

wherein at least one of the optical splitter, the optical delay waveguide array, the optical combiner and the optical gate has an optical amplitude adjustment function for adjusting ampllitudes of the optical signals.

2. The optical signal processing device of claim 1, wherein the optical delay waveguide array delays the optical signals and the optical amplitude adjustment function adjusts the amplitudes of the optical signals such that an amplitude of an output signal of the optical gate represents a digital-to-analog converted value of the optical signals.

3. The optical signal processing device of claim 1, wherein the input optical waveguide, the optical splitter, the optical delay waveguide array, the optical combiner, the output optical waveguide, and the optical gate are

provided on a substrate, and the optical gate is provided between the optical combiner and the output optical waveguide.

4. The optical signal processing device of claim 1, wherein the input optical waveguide, the optical splitter, the optical delay waveguide array, the optical combiner, and the output optical waveguide are provided on a substrate, and the optical gate is provided outside the substrate and connected to the output optical waveguide.

5. The optical signal processing device of claim 1, wherein the optical gate includes a plurality of optical gate elements respectively provided on the optical delay waveguides of the optical delay waveguide array.

6. The optical signal processing device of claim 5, further comprising:

a plurality of phase controllers respectively provided on the optical delay waveguides of the optical delay waveguide array after respective optical gate elements.

7. The optical signal processing device of claim 1, wherein the optical amplitude adjustment function adjusts the amplitudes of the optical signals such that the optical signals outputted from the optical delay waveguide array are combined by the optical combiner at respectively different intensities.

8. The optical signal processing device of claim 1, wherein the optical delay waveguides of the optical delay waveguide array are provided in forms of silica-based optical waveguides, and the optical amplitude adjustment function is realized by optical amplitude controllers respectively provided on the optical delay waveguides, each

optical amplitude controller being provided in a form of a Mach-Zehnder optical switch having a thin film heater formed on a corresponding silica-based optical waveguide which is connected with a thin film heater functioning as an optical modulator.

9. The optical signal processing device of claim 1, wherein either one or each one of the optical splitter and the optical combiner is provided in a form of a multi-mode interference optical coupler.

10. The optical signal processing device of claim 1, further comprising:

a TE/TM converter inserted in the optical delay waveguide array.

11. An optical signal processing device, comprising:

an input optical waveguide;

an optical splitter configured to split optical signals entered at the input optical waveguide into plural sets;

a first optical delay waveguide array formed by a plurality of optical delay waveguides with mutually different delay amounts which are configured to delay the optical signals split by the optical splitter;

a plurality of optical gates configured to gate the optical signals respectively provided on the optical delay waveguides and configured to gate the optical signals entered into the optical delay waveguide array;

an optical switch for switching the optical signals outputted from the optical delay waveguide array;

a second optical delay waveguide array formed by a plurality of optical delay waveguides with mutually different delay amounts which are configured to delay the optical signals switched by the optical switch;

an optical combiner configured to combine the optical signals delayed by the second optical delay waveguide array; and

an output optical waveguide connected to an output port of the optical combiner.

12. The optical signal processing device of claim 11, wherein the first optical delay waveguide array delays the optical signals such that the optical gates extract a group of the optical signals at an identical timing, and the optical switch switches the optical signals so as to interchange signals within the group of the optical signals.

13. The optical signal processing device of claim 11, wherein the optical delay waveguides of the first optical delay waveguide array and the second optical delay waveguide array are provided in forms of silica-based optical waveguides, and the optical switch realizes a switching function at each intersection between each input and each output in a form of a Mach-Zehnder optical switch having a thin film heater formed on a corresponding silica-based optical waveguide.

14. The optical signal processing device of claim 11, wherein either one or each one of the optical splitter and the optical combiner is provided in a form of a multi-mode interference optical coupler.

15. The optical signal processing device of claim 11, further comprising:

a TE/TM converter inserted in the optical delay waveguide array.